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EXAMINER	
MALDONADO, JULIO J	
ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 10/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

A

Office Action Summary	Application No.	Applicant(s)	
	10/647,534	DIP ET AL.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-8,10-12 and 17-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 2, 4-8, 10-12 and 17-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The cancellation of claims 3, 9 and 13-16, and the addition of claim 24 in the paper filed 07/31/2006 is acknowledged.

2. Claims 1, 2, 4-8, 10-12 and 17-24 are pending in the application.

Continued Examination Under 37 CFR 1.114

3. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 07/31/2006 has been entered.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 2, 5-8, 10-12 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. 6,589,877 B1) in view of Wolf et al. (Silicon Processing for the VLSI Era, Volume 1: Process Technology, hereinafter Wolf).

In reference to claims 1, 2, 5-8, 10, 11 and 24, Thakur (Fig.1) teaches a method of cleaning the surface of a substrate comprising silicon including the steps of growing a first layer of silicon oxide by thermal oxidation (Fig.1, 22D) on the surface of the

substrate; without forming further oxide on the first oxide layer etching said first oxide layer; growing a second silicon oxide layer by thermal oxidation; without forming further oxide on the second oxide layer, etching said second oxide layer; repeating said oxidation and etching steps as desired until removing contaminant or substrate surface damage, wherein said etching steps are performed using a dry etching process wherein said etchant is chlorine gas or hydrogen fluoride gas and wherein said etchant is dissociated to form radicals; and further processing the substrate in a clustered environment to further reduce the constituents such as contaminants that might appear (Thakur, column 2, line 39 – column 5, line 58 and column 8, lines 1 – 20).

Thakur fails to disclose using a plasma process to etch said oxide layer. However, Wolf in a related etching process teaches dissociating chlorine and hydrogen fluoride molecules in a plasma environment to form radicals (Wolf, page 544, second paragraph). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf to enable the etching step of Thakur to be performed according to the teachings of Wolf because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed etching step of Thakur and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combined teachings of Thakur and Wolf fail to expressly disclose monitoring said surface region of the substrate and repeatedly growing an additional ultra-thin oxide layer to consume additional defects and etching the additional oxide layer to

remove the consumed additional defects based on said monitoring of said surface region. However, it is inherent that there has to be an inspection step to detect level of contaminants on a substrate in order to continue or stopping said growing and etching steps until all of the contaminant or substrate surface damage has been removed.

The combined teachings of Thakur and Wolf teach wherein it is preferable to grow an oxide layer having a thickness 30 Å to 40 Å (Thakur, column 4, lines 45 – 50). The combined teachings of Thakur and Wolf fail to expressly disclose forming an oxide layer having a thickness of approximately 5 Å to 10 Å. However, the combination of Thakur and Wolf is open to a non-preferred embodiment wherein the grown oxide has a thickness of less than, for example, 30 Å. Furthermore, the combination of Thakur and Wolf teach growing an oxide layer by a rapid thermal oxidation process (RTO), wherein said oxide layer has a thickness of at least generally 10 Å (Thakur, column 4, lines 31 – 35). Although not taught as a preferred embodiment, Thakur in view of Wolf teach this embodiment nonetheless, and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 169 USPQ 423 (CCPA 1971). "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." In re Gurley, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. Merck & Co. v. Biocraft Laboratories, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). Even a teaching away from a claimed invention does not render the

invention patentable. See Celeritas Technologies Ltd. v. Rockwell International Corp., 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998), where the court held that the prior art anticipated the claims even though it taught away from the claimed invention. "The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed." To further clarify, a prior art opinion that a claimed invention is not preferred for a particular limited purpose, does not preclude utility of the invention for that or another purpose, or even preferability of the invention for another purpose.

Furthermore, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thickness disclosed in the combined teachings of Thakur and Wolf to arrive at the claimed invention.

Still, the combined teachings of Thakur and Wolf fail to expressly teach wherein repeatedly growing an oxide film to provide a substantially contaminant free substrate surface. However, the combination of Thakur and Wolf teach that said cleaning is open to any number of oxidation and cleaning steps as required (Thakur, column 8, lines 10 – 20). Therefore, the combined teachings of Thakur and Wolf are open to perform any number of cleaning steps to obtain a substantially contaminant-free substrate surface.

In reference to claim 12, the combined teachings of Thakur and Wolf teach processing a plurality of substrates including said substrate, wherein each of said

growing steps and each of said etching steps is performed on each of said plurality of substrates (Wolf, pages 230 – 234, and 568 – 574).

6. Claims 4 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (U.S. '877 B1) in view of Wolf (Silicon Processing for the VLSI Era, Volume 1: Process Technology) as applied to claims 1, 5-8, 10-12 and 24 above, and further in view of Park et al. (A study on modified silicon surface after CHF_3C/C_2F_6 reactive ion etching, hereinafter Park).

In reference to claim 4, the combined teachings of Thakur and Wolf substantially teach all aspects of the invention but fail to disclose wherein said monitoring comprises using high-resolution transmission electron microscopy (HRTEM) data. However, Park teaches a monitoring method to detect level of contaminants on a substrate, wherein said monitoring includes HRTEM (Abstract). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf with Park to enable monitoring the reduction of contaminants in the substrate of the combination of Thakur and Wolf according to the teachings of Park because one of ordinary skill in the art at the tie the invention was made would have been motivated to look to alternative suitable methods of monitoring the substrate of Thakur and Wolf and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

In reference to claims 17-20, the combined teachings of Thakur, Wolf and Park inherently teach wherein said monitoring includes imaging the surface of the substrate after removal of one of said ultra-thin oxide layers using HRTEM data. Further support

can be found in Wolf (Semiconductor Processing for the VLSI Era, Volume 1: Process technology, pages 586, 587 and 597-599) and Herbots et al. (Figs.6A-6B and column 19, lines 15 – 40) and furthermore, since the same monitoring is used, the same data results would be obtained.

7. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (877 B1) in view of Wolf (Silicon Processing for the VLSI Era, Volume 1: Process Technology) as applied to claims 1, 2, 5-8, 10-12 and 24 above, and further in view of Maydan et al. (U.S. 2004/0121605 A1, hereinafter Maydan).

The combined teachings of Thakur and Wolf substantially teach all aspects of the invention but fail to teach wherein the semiconductor substrate comprises silicon germanium. However, Maydan teaches a method of cleaning substrates including forming an oxide layer on a surface of a substrate, followed by removing said oxide, wherein said substrate comprises a material selected from the group including silicon and silicon germanium (Maydan, [0047]).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur and Wolf et al. to enable using a substrate in the combination of Thakur and Wolf et al. according to the teachings of Maydan et al. because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of using the disclosed substrate in Thakur and Wolf et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

8. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur (877 B1) in view of Wolf (Silicon Processing for the VLSI Era, Volume 1: Process Technology) and Maydan ('605 A1) as applied to claims 1, 2, 5-8, 10-12, 21 and 24 above, and further in view of Callegari et al. (U.S. 6,573,197 B2, hereinafter Callegari).

The combined teachings of Thakur, Wolf and Maydan teach forming said oxide layer using an RTO process, and using a plasma process to etch said oxide layer (Thakur, column 2, line 39 – column 5, line 58 and column 8, lines 1 – 20, and Wolf, page 544, second paragraph). The combination of Thakur, Wolf and Maydan fail to disclose growing said oxide layer using a plasma assisted process. However, Callegari in a related method to form oxide layers on a silicon or silicon germanium substrate, teaches forming oxide layers of 10Å or less using, for example, RTO or direct plasma oxidation process (Callegari, column 3, lines 60 – 65 and column 4, lines 23 – 34). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur, Wolf and Maydan with Callegari to enable the oxidation step of Thakur, Wolf and Maydan to be performed according to the teachings of Callegari because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed oxidation step of Thakur, Wolf and Maydan and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Response to Arguments

9. Applicants' arguments filed 07/31/2006 have been fully considered but they are not persuasive.

Applicants argue, "...Thakur makes clear that a thickness of the oxide after the RTO step 22d is 30-40Å, whether the oxide is performed by step 22d alone or a combination of steps 22a and 22d. That is, a step 22d RTO oxide growth of 10Å may be used in combination with step 22a growth to obtain a total thickness of 30 to 40Å. Column 5 indicates that this total oxide thickness may be removed as a sacrificial oxide. However, there is no indication in Thakur that the oxide thickness to be removed is less than 15Å as now clearly recited in Claim 1...". In response to this argument, and as stated hereinabove, the combined teachings of Thakur and Wolf teach wherein it is preferable to grow an oxide layer having a thickness 30 Å to 40 Å (Thakur, column 4, lines 45 – 50). The combined teachings of Thakur and Wolf fail to expressly disclose forming an oxide layer having a thickness of approximately 5 Å to 10 Å. However, the disclosed language in the combination of Thakur and Wolf is open to a non-preferred embodiment wherein the grown oxide has a thickness of less than, for example, 30 Å. Furthermore, the combination of Thakur and Wolf teach growing an oxide layer by a rapid thermal oxidation process (RTO), wherein said oxide layer has a thickness of at least generally 10 Å (Thakur, column 4, lines 31 – 35). Although not taught as a preferred embodiment, Thakur in view of Wolf teach this embodiment nonetheless, and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 169 USPQ 423 (CCPA 1971). "A

known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." In re Gurley, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. Merck & Co. v. Biocraft Laboratories, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). Even a teaching away from a claimed invention does not render the invention patentable. See Celeritas Technologies Ltd. v. Rockwell International Corp., 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998), where the court held that the prior art anticipated the claims even though it taught away from the claimed invention. "The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed." To further clarify, a prior art opinion that a claimed invention is not preferred for a particular limited purpose, does not preclude utility of the invention for that or another purpose, or even preferability of the invention for another purpose. Furthermore, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thickness disclosed in the combined teachings of Thakur and Wolf to arrive at the claimed invention.

Applicants also argue, "...The Office Action makes no effort to explain why it is believed that it is necessary to detect a level of contaminants on the substrate in order to continue or stop growing an etching step until the substrate is substantially free of

contaminants. Applicants submit that such monitoring is not necessary. For example, the oxide growth and etch process could be stopped after an arbitrary number of cycles based on historical data. This requires no monitoring of the substrate surface at all. Thus, Applicants' monitoring step provides an additional basis for patentability of Claim 1 over the cited references...". In response to this argument, applicants assert that "the oxide growth and etch process could be stopped after an arbitrary number of cycles based on historical data", as argued. However, in order to obtain said historical data, several test results must have been obtained. At some point, there has to be a monitoring of test substrates in order to obtain results that would be recorded and treated as historical data. Therefore, and as stated herein above, it is inherent that there has to be an inspection step to detect level of contaminants on a substrate in order to continue or stopping said growing and etching steps until all of the contaminant or substrate surface damage has been removed.

Conclusion

10. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (http://portal.uspto.gov/external/portal/pair) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

12. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at http://www.uspto.gov/web/info/2800.htm.

Julio J. Maldonado
Patent Examiner
Art Unit 2823

Julio J. Maldonado
September 28, 2006

George Fourson
Primary Examiner